

REMARKS

Claims 8-11 and 13-16 are pending. The support for the claim amendments is found in the published application as follows: Claim 1: [0038]; and Claims 9-11 and 13-16: grammatical clarifications. No new matter has been added.

Claims 8-15 are rejected under 35 USC 102(b) as being anticipated by Idemura et al. (USP 6,063,862). (Office Action p.2)

Idemura describes that a polyamide-glass composite is obtained by bringing (A) a layer of an aqueous solution comprising water, *water glass* and a diamine monomer into contact with (B) a layer of an organic solution comprising an organic solvent and an acylated dicarboxylic acid monomer, and performing a polycondensation reaction of the monomers on the interface between the layers of the solutions (see Abstract; col.3, line 66 to col.4, line 6; col. 4, lines 34 to 44).

Claim 8 has been amended to recite that main metal elements are selected from the group consisting of 13 Al, 31 Ga, 32 Ge, 49 In, 50 Sn, 51 Sb, 82 Pb and 83 Bi. Si of group 14 is excluded from the main metal elements of the claimed invention, and claim 12 regarding water glass has been canceled.

Amended claim 8 and its dependent claims 9 to 11 and 13 to 16 are therefore not anticipated by Idemura.

In addition, claim 8 and claims dependent thereon are also not obvious over the cited art for several reasons as explained below.

The method for producing an organic-inorganic composite material of the claimed invention is characterized by the following (if a polyamide is taken as an example):

(1) An alkali metal such as sodium aluminate is used in the reaction for synthesizing a polyamide by reacting a dicarboxylic acid halide with a diamine. Specifically, it serves as a depleting agent of a hydrogen halide generated during polymerization, and becomes a water-soluble alkali halide (see [0024], [0039] of the published application).

(2) The reaction for synthesizing a polyamide by reacting a dicarboxylic acid halide and a diamine, and the precipitation of an inorganic compound such as aluminum oxide (which is produced by the removal of the alkali metal from sodium aluminate) are carried out

complementarily (see [0024]).

As a result, a composite in which fine particles of the inorganic compound are uniformly and finely dispersed in the polyamide at a high content can be obtained.

Contrary to the allegation in the rejection of claim 16 below, it is not obvious to a person skilled in the art to modify the method of Idemura by incorporating the *non-silicon metal oxide species, such as aluminum oxide, of Enomoto* in the composite, for several reasons, including the following:

First, it is described in Enomoto that an inorganic fine particle sol is added to a reaction system of a thermoplastic resin, *but is not described that sodium aluminate is added to the reaction system*. As mentioned above, sodium aluminate of Enomoto is used in the preparation of the metal oxide sol (see col.9, line 30 of Example 1).

Second, it is *not* described or *suggested in Idemura* regarding using an *alkali metal compound other than water glass*.

Third, with regard to the reaction of the present invention, a dicarboxylic acid halide is reacted with a diamine to produce a polyamide (see [0032]). *In parallel to this reaction, a metal compound* having a metal element other than an alkali metal element (hereinafter referred to as a “metal compound (2)”) in at least one metal compound of at least one of a metal oxide, a metal hydroxide and a metal carbonate of at least one alkali metal element and at least one metal element selected from the group consisting of groups 3 to 12 transition metal elements of the periodic table and main metal elements selected from the group consisting of 13 Al, 31 Ga, 32 Ge, 49 In, 50 Sn, 51 Sb, 82 Pb and 83 Bi of the periodic table (hereinafter referred to as a “metal compound (1)”) *is transformed to a solid*.

In the present invention, the *transformation of the metal compound (2) to a solid depends on the reaction of the metal compound (1) with a hydrogen halide*. Specifically, it is performed by a *two-stage reaction* including a *reaction of producing a hydroxyl group* by the ion exchange reaction of an alkali metal ion in the metal compound (1) and a proton in the hydrogen halide, and a reaction of inducing a *dehydration polycondensation reaction* between the hydroxyl groups. This *reaction takes place on an aqueous phase side* since the metal compound (1) is used by being dissolved in water (see [0042]).

Furthermore, this transformation rate to a solid (which is generally referred to as a “sol-

gel reaction”) varies depending on each of the metal compounds (1) (for example, sodium aluminate, sodium tartrate, and potassium zirconium carbonate). *Also, a metal compound and an Si compound such as water glass have different transformation rates.* Generally, the *sol gel reaction rate of Si is slower* than the reaction rate when a metal species such as Al, Zr, or Ti is used (see Reference Document 1 & partial translation: Science of Sol-Gel Method, Sumio Satsuka, 1992, page 25; Reference Document 2 & partial translation: Technical Problems in Sol-Gel method and Solution thereof, Masayuki Yamane, 1990, pages 19 to 20, and 147). Furthermore, the comparison with the reaction rates of Al, Ti, and Zr shows: $Al > Ti \geq Zr$ (see Reference Document 3 & partial translation: Handbook of Crosslinking Agent, Shinzo Yamashita et al., 1990, Tables 8-5 on page 301).

It is not described or suggested in neither Idemura nor Enomoto on how it will be if the metal compound (1) exists at the same time in a reaction where a polycondensation reaction of the above polymers is performed. In fact, in the reaction where the polycondensation reaction of the polymers of present invention, a side reaction in which an acid chloride is reacted with water to produce a carboxylic acid and HCl occurs, and from the viewpoints that the HCl promotes the transformation reaction of the metal compound (1) and that the reaction rate in the case of using a metal species such as Al, Zr, or Ti is faster than that of the sol gel reaction of Si as described above, it is expected that the metal compound (2) is predominantly transformed and precipitated due to an excessive amount of HCl which had been produced by a reaction of the acid chloride with water.

That is, from the invention of Idemura, with considering the disclosure of Enomoto or the general knowledge of a person skilled in the art about an alkali metal compound, it is believed that in order to obtain a composite with a polyamide containing various metal compounds, the use of sodium aluminate, sodium tartrate, or an alkali metal zirconate having a faster transformation rate to a solid than water glass, allows *“the precipitation of the metal compound (2) from the metal compound (1) to predominantly proceed faster than the reaction for synthesizing a polymer, and as a result, the inorganic fine particle is coarsened, a composite is not produced, and the inorganic particle leaves the organic polymer.”* Accordingly, it is not obvious to a person skilled in the art to conceive that “when sodium aluminate, sodium tartrate, or an alkali metal zirconate are used, an organic-inorganic composite material can be obtained in the same manner as for water glass”.

Fourth, the water glass in Idemura is substituted with the metal oxide sol, as disclosed in Enomoto, and the *solid and the polyamide are separated* because the metal oxide sol is a solid. That is, it is different with the *claimed invention* in which a *reaction for synthesizing a polyamide* by reacting a dicarboxylic acid halide with a diamine and the *precipitation of an inorganic compound* such as aluminum oxide (which is produced by the removal of the alkali metal from sodium aluminate) are *performed complementarily to each other*. Accordingly, an organic-inorganic composite “in which fine particles of the inorganic compound are uniformly and finely dispersed in the polyamide at a high content,” is an effect of the claimed invention, cannot be obtained by the prior art or combined methods thereof.

As a result, claim 8 of the present invention and its dependent claims 9 to 11, and 13 to 16 are not clearly obvious to a skilled person in the art in light of the cited references.

Claim 16 is rejected under 35 USC 103(a) as being unpatentable over Idemura et al. (USP 6,063,862) in view of Enomoto et al. (USP 5,880,201). (Office Action p.3)

Enomoto relates to a film containing a composite oxide sol in a thermoplastic resin, wherein the composite oxide sol is obtained by producing a colloidal particle obtained by adding a silicate of an alkali metal or the like and an alkali-soluble inorganic compound simultaneously to an alkali solution having pH of 9 or above (see col.5, lines 38 to 56; col.6, lines 14 to 26). It is described that the composite oxide sol is a colloidal particle having a network structure in which silicon and an inorganic oxide element other than silicon are bonded through oxygen (see col.6, lines 52 to 64). As an example of the alkali-soluble inorganic compound which is a starting material of the composite oxide sol, sodium aluminate is described (see col.6, lines 3 to 13).

It is described in Embodiment 7 that a composite oxide sol of $\text{SiO}_2\text{-TiO}_2\text{-Na}_2\text{O}$ in Example 7 is subjected to a polymer synthesis in the coexistence of the monomers such as caprolactam, and a polyimide containing the metal oxide sol is obtained (see col.16, lines 43 to 64). In the reference, *sodium aluminate is used in the preparation of the metal oxide sol* (see col.9, line 30 of Example 1), and *there is no description of an example of addition thereof in the synthesis of a polymer such as a polyimide*.

As explained above, the combination of references alone cannot create a *prima facie* rejection of obviousness. Thus it is respectfully requested that the rejection be reconsidered and

withdrawn.

In view of the above amendment to the claims, applicant believes the pending application is in condition for allowance.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 04-1105.

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Respectfully submitted,

Customer No. 21874

Electronic signature: /James E. Armstrong, IV/
James E. Armstrong, IV

Registration No.: 42,266
EDWARDS ANGELL PALMER & DODGE
LLP

P.O. Box 55874
Boston, Massachusetts 02205
(202) 478-7375
Attorneys/Agents For Applicant

Encls: Reference document 1 (3 pages)
Reference document 2 (5 pages)
Reference document 3 (5 pages)